

IN THE CLAIMS:

1.-3. (cancelled)

4. (currently amended) A method of manufacturing a silicon single crystal ingot by Czochralski method or MCZ method, wherein silicon single crystal pulling is performed in a range of nitrogen concentration and oxygen concentration, which falls within an area in a graph in which the oxygen concentration and the nitrogen concentration are plotted along the horizontal axis and the vertical axis of the graph, respectively, on or below a first straight line connecting a point at which the nitrogen concentration is 3×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and a point at which the nitrogen concentration is 3×10^{14} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³, and wherein the nitrogen concentration increases gradually from a shoulder portion to a tail portion of the silicon single crystal ingot whereas the oxygen concentration decreases gradually from the shoulder portion to the tail portion, and wherein the nitrogen and oxygen concentrations make a second line from the shoulder portion to the tail portion of the silicon single crystal ingot substantially parallel to the first straight line.

5. (currently amended) A method of manufacturing a silicon single crystal ingot by Czochralski method or MCZ method, wherein silicon single crystal pulling is performed in a range of nitrogen concentration and oxygen concentration, which falls within an area in a graph in which the oxygen concentration and the nitrogen concentration are plotted along the horizontal axis and the vertical axis of the graph, respectively, on or below a first straight line connecting a point at which the nitrogen concentration is 3×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and a point at which the nitrogen concentration is 3×10^{14} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³, wherein the nitrogen concentration increases gradually from a shoulder portion to a tail portion of the silicon single crystal ingot whereas the oxygen concentration decreases gradually from the shoulder portion to the tail portion, and ~~The method according to claim 4,~~ wherein the nitrogen concentration in the tail portion is set less than 3×10^{15} atoms/cm³.

6.-7. (cancelled)

8. (previously amended) A silicon ingot prepared by Czochralski or MCZ method, wherein nitrogen concentration of a tail portion of the silicon ingot is from 1×10^{15} atoms/cm³ to 3×10^{15} atoms/cm³, and wherein oxygen concentration is lowered corresponding to an increase in nitrogen concentration from a shoulder portion to the tail portion such that the nitrogen concentration and the oxygen concentration along a longitudinal direction of the silicon ingot vary in accordance with a second line in a graph in which the oxygen concentration and the nitrogen concentration are plotted along the horizontal axis and the vertical axis of the graph, respectively, substantially parallel to a first straight line connecting a point at which the nitrogen concentration is 3×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and a point at which the nitrogen concentration is 3×10^{14} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³.

9. (previously presented) The silicon ingot according to claim 8, wherein the oxygen concentration in the silicon ingot is controlled corresponding to a change in the nitrogen concentration in the silicon ingot.

10.-12. (cancelled)

13. (currently amended) The epitaxial silicon wafer according to claim 2 32, wherein the range of nitrogen concentration and oxygen concentration in the silicon wafer substrate falls within an area in the graph on or below a second straight line connecting a point at which the nitrogen concentration is 1×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and a point at which the nitrogen concentration is 9×10^{13} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³.

14. (previously presented) An epitaxial silicon wafer including a silicon wafer substrate doped with nitrogen on which an epitaxial film is formed,
wherein a range of nitrogen concentration and oxygen concentration in the silicon wafer substrate falls within an overlapping area in a graph in which the oxygen concentration and

the nitrogen concentration are plotted along the horizontal axis and the vertical axis of the graph, respectively,

on or below a first straight line connecting a point at which the nitrogen concentration is 3×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and a point at which the nitrogen concentration is 3×10^{14} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³, and

on or above a third straight line which is substantially parallel to the first straight line and passes a point at which the nitrogen concentration is 1×10^{14} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ such that the epitaxial silicon wafer has sufficient quantity of gettering sites.

15. (currently amended) The epitaxial silicon wafer according to claim ~~12~~14, wherein the range of nitrogen concentration and oxygen concentration in the silicon wafer substrate falls within an overlapping area in a graph,

on or below a second straight line connecting a point at which the nitrogen concentration is 1×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and a point at which the nitrogen concentration is 9×10^{13} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³, and

on or above a fourth straight line which is substantially parallel to the second straight line and passes a point at which the nitrogen concentration is 3×10^{14} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ such that the epitaxial silicon wafer has sufficient quantity of gettering sites.

16. (currently amended) The epitaxial silicon wafer according to claim ~~12~~14, wherein the range of nitrogen concentration and oxygen concentration in the silicon wafer substrate falls within an overlapping area in a graph,

on or above a second straight line connecting a point at which the nitrogen concentration is 1×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and a point at which the nitrogen concentration is 9×10^{13} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³.

17. (previously presented) A group of epitaxial silicon wafers including respective silicon wafer substrates doped with nitrogen on which epitaxial films are formed wherein a range of nitrogen concentration and oxygen concentration in each of the silicon wafer substrates falls within an overlapping area in a graph in which the oxygen concentration and the nitrogen concentration are plotted along the horizontal axis and the vertical axis of the graph, respectively, on or below a first straight line connecting a point at which the nitrogen concentration is 3×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and a point at which the nitrogen concentration is 3×10^{14} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³ and on or above a fourth line which is substantially parallel to the first straight line and passes a point at which the nitrogen concentration is 3×10^{14} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ such that each of the epitaxial silicon wafers has sufficient quantity of gettering sites, and wherein the silicon wafer substrates are prepared from a single ingot.

18. (previously presented) A group of epitaxial silicon wafers including respective silicon wafer substrates doped with nitrogen on which epitaxial films are formed wherein a range of nitrogen concentration and oxygen concentration in each of the silicon wafer substrates falls within an overlapping area in a graph in which the oxygen concentration and the nitrogen concentration are plotted along the horizontal axis and the vertical axis of the graph, respectively, on or below a second straight line connecting a point at which the nitrogen concentration is 1×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and a point at which the nitrogen concentration is 9×10^{13} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³ and on or above a third straight line which is substantially parallel to the second straight line and passes a point at which the nitrogen concentration is 1×10^{14} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ such that each of the epitaxial silicon wafers has sufficient quantity of gettering sites, and wherein the silicon wafer substrates are prepared from a single ingot.

19.-21. (cancelled)

22. (previously presented) A method of manufacturing the epitaxial silicon wafer prepared from the silicon wafer substrate sliced from the silicon single crystal ingot manufactured by the method recited in claim 4, comprising:

grinding the silicon wafer substrate, and
performing epitaxial growth on the ground silicon wafer.

23.-24. (cancelled)

25. (previously presented) A method of manufacturing the epitaxial silicon wafer prepared from the silicon wafer substrate sliced from the silicon single crystal ingot recited in claim 8, comprising:

grinding the silicon wafer substrate, and
performing epitaxial growth on the ground silicon wafer.

26. (currently amended) A method of manufacturing the epitaxial silicon wafer recited in claim ~~4~~14, comprising:

grinding the silicon wafer substrate, and
performing epitaxial growth on the ground silicon wafer.

27. (currently amended) A method of manufacturing the epitaxial silicon wafer recited in claim ~~4~~15, comprising:

grinding the silicon wafer substrate, and
performing epitaxial growth on the ground silicon wafer.

28. (currently amended) A method of manufacturing the group of epitaxial silicon wafer recited in claim ~~4~~17, comprising:

grinding the silicon wafer substrate, and
performing epitaxial growth on each of the ground silicon wafers.

29. (currently amended) A method of manufacturing the group of epitaxial silicon

wafers recited in claim ~~46~~18, comprising:

grinding the silicon wafer substrate, and
performing epitaxial growth on each of the ground silicon wafers.

30. (previously presented) An epitaxial silicon wafer including a silicon wafer substrate doped with nitrogen on which an epitaxial film is formed, wherein a range of nitrogen concentration and oxygen concentration in the silicon wafer substrate falls within an overlapping area in a graph in which the oxygen concentration and the nitrogen concentration are plotted along the horizontal axis and the vertical axis of the graph, respectively, on or below a first straight line connecting a point at which the nitrogen concentration is 3×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and a point at which the nitrogen concentration is 3×10^{14} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³ and on or above a horizontal straight line on which the nitrogen concentration is 1×10^{13} atoms/cm³, and between vertical straight lines on which the oxygen concentrations are 9×10^{17} atoms/cm³ and 1.6×10^{18} atoms/cm³, respectively.

31. (previously presented) An epitaxial silicon wafer including a silicon wafer substrate doped with nitrogen on which an epitaxial film is formed, wherein a range of nitrogen concentration and oxygen concentration in the silicon wafer substrate falls within an overlapping area in a graph in which the oxygen concentration and the nitrogen concentration are plotted along the horizontal axis and the vertical axis of the graph, respectively, on or below a first straight line connecting a point at which the nitrogen concentration is 3×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and a point at which the nitrogen concentration is 3×10^{14} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³ and on or above a horizontal straight line on which the nitrogen concentration is 1×10^{14} atoms/cm³, and between vertical straight lines on which the oxygen concentrations are 9×10^{17} atoms/cm³ and 1.6×10^{18} atoms/cm³, respectively.

32. (previously presented) An epitaxial silicon wafer including a silicon wafer substrate doped with nitrogen on which an epitaxial film is formed, wherein the number of crystal defects observed as Light Point Defects of 120 nm or more on the epitaxial film is 20 pieces/200-mm wafer or less and wherein a range of nitrogen concentration and oxygen concentration in the silicon wafer

substrate falls within an area in a graph in which the oxygen concentration and the nitrogen concentration are plotted along the horizontal axis and the vertical axis of the graph, respectively, on or below a first straight line connecting a point at which the nitrogen concentration is 3×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and a point at which the nitrogen concentration is 3×10^{14} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³, and on or above a horizontal straight line on which the nitrogen concentration is 1×10^{13} atoms/cm³; wherein the oxygen concentration and the nitrogen concentration are adjusted in a manner that the oxygen concentration and the nitrogen concentration have a predetermined correlative relationship of the nitrogen concentration increase corresponding to the oxygen concentration decrease and the nitrogen concentration decrease corresponding to the oxygen concentration increase such that the epitaxial silicon wafer has sufficient quantity of gettering sites.

33. (currently amended) An epitaxial silicon wafer including a silicon wafer substrate doped with nitrogen on which an epitaxial film is formed, wherein the number of crystal defects observed as Light Point Defects of 120 nm or more on the epitaxial film is 20 pieces/200-mm wafer or less and wherein a range of nitrogen concentration and oxygen concentration in the silicon wafer substrate falls within an area in a graph in which the oxygen concentration and the nitrogen concentration are plotted along the horizontal axis and the vertical axis of the graph, respectively, on or below a first straight line connecting a point at which the nitrogen concentration is 3×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and a point at which the nitrogen concentration is 3×10^{14} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³, and on or above a horizontal second straight line on which the nitrogen concentration is 1×10^{14} atoms/cm³; wherein the oxygen concentration and the nitrogen concentration are adjusted in a manner that the oxygen concentration and the nitrogen concentration have a predetermined correlative relationship of the nitrogen concentration increase corresponding to the oxygen concentration decrease and the nitrogen concentration decrease corresponding to the oxygen concentration increase such that the epitaxial silicon wafer has sufficient quantity of gettering sites.

34.-35. (cancelled)

36. (currently amended) A method of manufacturing a silicon single crystal ingot by Czochralski method or MCZ method, wherein silicon single crystal pulling is performed in a range of nitrogen concentration and oxygen concentration, which falls within an area in a graph in which the oxygen concentration and the nitrogen concentration are plotted along the horizontal axis and the vertical axis of the graph, respectively, on or below a first straight line connecting a point at which the nitrogen concentration is 3×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and a point at which the nitrogen concentration is 3×10^{14} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³, and on or above a horizontal second straight line on which the nitrogen concentration is 1×10^{13} atoms/cm³; wherein the nitrogen concentration increases gradually from a shoulder portion to a tail portion of the silicon single crystal ingot whereas the oxygen concentration decreases gradually from the shoulder portion to the tail portion and wherein the nitrogen and oxygen concentrations in the ingot make a third line on the graph from the shoulder portion to the tail portion of the silicon single crystal ingot substantially parallel to the first straight line.

37. (currently amended) A method of manufacturing a silicon single crystal ingot by Czochralski method or MCZ method, wherein silicon single crystal pulling is performed in a range of nitrogen concentration and oxygen concentration, which falls within an area in a graph in which the oxygen concentration and the nitrogen concentration are plotted along the horizontal axis and the vertical axis of the graph, respectively, on or below a first straight line connecting a point at which the nitrogen concentration is 3×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and a point at which the nitrogen concentration is 3×10^{14} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³, and on or above a horizontal second straight line on which the nitrogen concentration is 1×10^{14} atoms/cm³; wherein the nitrogen concentration increases gradually from a shoulder portion to a tail portion of the silicon single crystal ingot whereas the oxygen concentration decreases gradually from the shoulder portion to the tail portion and wherein the nitrogen and oxygen concentrations in the ingot make a third line from the shoulder portion to the tail portion of the silicon single crystal ingot substantially parallel to the first straight line.

38. (currently amended) A nitrogen-doped silicon wafer, wherein a range of nitrogen concentration and oxygen concentration falls within an area in a graph in which the oxygen

concentration and the nitrogen concentration are plotted along the horizontal axis and the vertical axis of the graph, respectively, on or below a first straight line connecting a point at which the nitrogen concentration is 3×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and a point at which the nitrogen concentration is 3×10^{14} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³, and on or above a horizontal second straight line on which the nitrogen concentration is 1×10^{13} atoms/cm³; wherein the oxygen concentration and the nitrogen concentration are adjusted in a manner that the oxygen concentration and the nitrogen concentration have a predetermined correlative relationship of the nitrogen concentration increase corresponding to the oxygen concentration decrease and the nitrogen concentration decrease corresponding to the oxygen concentration increase and wherein the nitrogen and oxygen concentrations in the ingot make a third line from the shoulder portion to the tail portion of the silicon single crystal ingot substantially parallel to the first straight line.

39. (currently amended) A nitrogen-doped silicon wafer, wherein a range of nitrogen concentration and oxygen concentration falls within an area in a graph in which the oxygen concentration and the nitrogen concentration are plotted along the horizontal axis and the vertical axis of the graph, respectively, on or below a first straight line connecting a point at which the nitrogen concentration is 3×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and a point at which the nitrogen concentration is 3×10^{14} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³, and on or above a horizontal second straight line on which the nitrogen concentration is 1×10^{14} atoms/cm³; wherein the oxygen concentration and the nitrogen concentration are adjusted in a manner that the oxygen concentration and the nitrogen concentration have a predetermined correlative relationship of the nitrogen concentration increase corresponding to the oxygen concentration decrease and the nitrogen concentration decrease corresponding to the oxygen concentration increase and wherein the nitrogen and oxygen concentrations in the ingot make a third line from the shoulder portion to the tail portion of the silicon single crystal ingot substantially parallel to the first straight line.

40. (currently amended) A nitrogen-doped silicon wafer, wherein a range of nitrogen concentration and oxygen concentration falls within an area in a graph in which the oxygen

concentration and the nitrogen concentration are plotted along the horizontal axis and the vertical axis of the graph, respectively, on or below a ~~second~~ first straight line connecting a point at which the nitrogen concentration is 1×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and the nitrogen concentration is 9×10^{13} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³, and on or above a horizontal second straight line on which the nitrogen concentration is 1×10^{13} atoms/cm³; wherein the oxygen concentration and the nitrogen concentration are adjusted in a manner that the oxygen concentration and the nitrogen concentration have a predetermined correlative relationship of the nitrogen concentration increase corresponding to the oxygen concentration decrease and the nitrogen concentration decrease corresponding to the oxygen concentration increase.

41. (currently amended) A nitrogen-doped silicon wafer, wherein a range of nitrogen concentration and oxygen concentration falls within an area in a graph in which the oxygen concentration and the nitrogen concentration are plotted along the horizontal axis and the vertical axis of the graph, respectively, on or below a ~~second~~ first straight line connecting a point at which the nitrogen concentration is 1×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and the nitrogen concentration is 9×10^{13} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³, and on or above a horizontal second straight line on which the nitrogen concentration is 1×10^{14} atoms/cm³; wherein the oxygen concentration and the nitrogen concentration are adjusted in a manner that the oxygen concentration and the nitrogen concentration have a predetermined correlative relationship of the nitrogen concentration increase corresponding to the oxygen concentration decrease and the nitrogen concentration decrease corresponding to the oxygen concentration increase.

42. (new) A method of manufacturing an epitaxial wafer comprising:
pulling a silicon ingot by Czochralski method or MCZ method, wherein nitrogen is doped in the silicon ingot such that a nitrogen concentration in a tail portion of the silicon ingot is set to be less than 3×10^{15} atoms/cm³ and wherein an oxygen concentration in the silicon ingot is adjusted corresponding to a change of the nitrogen concentration in the silicon ingot:
slicing the silicon ingot to obtain a silicon wafer; and
performing epitaxial growth on the sliced silicon wafer.

43. (new) The method according to claim 42, wherein a range of nitrogen concentration and oxygen concentration in the silicon ingot falls within an overlapping area in a graph in which the oxygen concentration and the nitrogen concentration are plotted along the horizontal axis and the vertical axis of the graph, respectively, on or below a first straight line connecting a point at which the nitrogen concentration is 3×10^{15} atoms/cm³ when the oxygen concentration is 7×10^{17} atoms/cm³ and a point at which the nitrogen concentration is 3×10^{14} atoms/cm³ when the oxygen concentration is 1.6×10^{18} atoms/cm³ and on or above a horizontal second straight line on which the nitrogen concentration is 1×10^{13} atoms/cm³, and between vertical third and fourth straight lines on which the oxygen concentrations are 9×10^{17} atoms/cm³ and 1.6×10^{18} atoms/cm³, respectively.